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Digital Literacy for Business Leaders and Managers

Completed Research Paper

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Abstract

The digital business environment offers opportunities to develop new business models and support organizational growth. It also brings fast-paced changes, global competition, and turbulence. To benefit from these opportunities, business leaders and managers must adapt and develop the relevant capabilities in this context. However, the literature falls short in describing the competencies required by professionals that lead the digital transformation journey. To address this gap, we conducted a panel with digital transformation experts. We also performed a systematic literature review to identify the competencies needed to lead optimally in the digital business environment. Our results present four categories of competencies based on experts and literature: Technical, Managerial, Social, and Motivational. Our findings bring insights for future research on long-life learning for business leaders and managers. They also inform practice about the relevance of digital literacy in leading an organization's digital transformation successfully and sustainably.

Keywords: Digital Literacy, Business leaders, Managers, Competencies, Digital Transformation

Introduction

Digital transformation fosters the rise of an increasingly globalized world in which new technologies provide many challenges and opportunities (Kuzin 2018). For the past decades, technological advancements have been causing profound changes in business, economic and social relations. Companies operate in an unpredictable, fast, and volatile world. It requires business decisions to integrate the appropriate disruptive technologies such as Big Data, artificial intelligence, IoT (internet of things), cloud computing, social media, and so forth to remain relevant and competitive (Kwon and Park 2017). Hence, the constant challenge of innovating by leading transformation arises for people and organizations (Lavalle and Casale 2020), as well as sociotechnical capabilities that allow exploiting digital technologies to their full potential and new business opportunities and business models (Bordeleau et al. 2021).

Digital technologies are radically pushing changes to existing business models and significantly impacting competencies required for business leaders to manage their organization's transformation journey (Erceg and Zoranović 2020). The digital business environment changed the nature of work, allowing people to work and

collaborate regardless of time and space barriers (Dittes et al. 2019). The digital business environment combines different digital business ecosystems that work collectively to co-create value (Senyo et al. 2019).

The existing scientific literature mainly discusses digital transformation in terms of technological and hard aspects (Vial 2019), business strategy (Schwertner 2017), customer engagement (Sahu et al. 2018), and new business models (Matt et al. 2015). Although recent research suggests that leaders must develop digital literacy in this fast-paced business world (Kane, 2019; Schrage et al. 2021), previous research falls short in identifying and describing the digital literacy competencies required for professionals leading the digital transformation within their organization. Research on digital competencies has been focusing mainly on competencies for the workforce (van Laar, van Deursen et al. 2020), students (Ben Youssef et al. 2022), and project management (Marnewick and Marnewick 2021). Few studies paid attention to the leadership competencies in Industry 4.0 or the digital transformation context (Guzmán et al. 2020; Łupicka and Grzybowska 2018; Sousa and Rocha). Competencies required by leaders to supervise and handle digital transformation successfully have been very little addressed (Singh and Hess). Therefore, leaders are looking for a roadmap to help these changes by reassessing their role within their company (Lavalle and Casale). To address this gap in the literature and contribute to managerial practices, this paper aims to answer the following research question: *What are the required competencies to lead in the digital business environment?* Then, the main objective of this research is to identify the necessary competencies for managers and business leaders to guide their organizations to thrive in the digital business environment.

To do so, we first promoted a panel with digital transformation experts to discuss the role of managers and business leaders during this journey and to ask them about the main competencies needed to achieve it. We coded and analyzed the insights of the experts' panel. Then, we conducted a systematic literature review to investigate previous research advances regarding this topic. By adopting a template analysis approach, we identified four categories of competencies for the digital literacy of business leaders and managers that emerged from the panel and literature. The competencies identified contribute to future research regarding long-life learning for business leaders and managers as an essential driver for successful and sustainable digital transformation for businesses and our society. It also contributes to managerial practices by informing business leaders and managers about the relevance of digital literacy to leading their company's digital transformation. This paper is organized as follows. The first section presents the research background, followed by the research method employed for this study. Then, the results section describes findings and discussions based on the results. Finally, the conclusion section highlights our contribution, limitations, and avenues for future research.

Research Background

The definition of digital literacy has changed over the years as the use and forms of technology have dramatically changed, affecting both organizations and private life (Reddy et al. 2020). The American Library Association (ALA) broadly defines digital literacy as "the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills" (Eshet 2004). Ashet-Alkalai framework on digital literacy distinguishes five types of digital literacy: 1) photo-visual literacy (learning to read from visuals); 2) information literacy (constantly questioning information); 3) socio-emotional literacy (emotional and social aspects of working in cyberspace); 4) branching literacy (hypermedia and thinking or multiple-domain thinking); and 5) reproduction literacy (creative duplication).

Digital literacy's definition includes a set of competencies required by individuals to optimize their use of digital tools and support them in achieving their goals. It thus consists of a set of competencies that brings together several skills, attitudes, and knowledge related to information and communication (Eshet 2004; Łupicka and Grzybowska 2018). Digital literacy is paramount for business leaders and managers in leading an optimal digital transformation (Borovskikh and Kipervar 2019; Łupicka and Grzybowska 2018). In other words, digital literacy is much more about information-related and communication-related competencies than the entire breadth of management skills in digital transformation. Digital literacy enables business leaders and managers to promote a transformational vision within their organization while maximizing adaptability (Carillo 2017). Leaders and managers must support the organization and its workforce by providing them with tools and methods of improvement, allowing them to level up at the same pace as the organization.

Competencies for Managers

After analyzing over 500 qualification models, Goleman, Boyatzis, and McKee (2013) concluded that distinguished managers require three competencies to deliver an outstanding performance: technical, cognitive, and emotional intelligence (Goleman et al. 2013).

Technical competencies are related to professional training and practical experience in a particular field. A qualified professional has the knowledge (theoretical training) and practical activity (experience) to perform a specific task. Cognitive competencies describe a person's intelligence and experience. This type of competency acts as a bridge between managers' technical competencies and higher-level emotional competencies. Hence, Goleman et al. (2013) explained the emotional intelligence competencies, and characteristics of high-performance managers, by dividing them into the following categories: self-awareness (e.g., emotional self-awareness, confidence), social awareness (e.g., empathy, organization awareness), self-management (e.g., adaptability, initiative), and relationship management (e.g., inspiring, development of others) (Goleman et al. 2013). These emotional intelligence competencies can therefore affect social and motivational aspects of leaders' and managers' performance.

Research Method

We created the initial template based on the competencies identified during an expert panel conducted online by the researchers in November 2020, during the COVID-19 pandemic, where the need for digital competencies was emphasized. Two of the three authors conducted the panel and gathered six consultants specialized in supporting organizations in the digital transformation journey. For one hour, the authors discussed and collected experts' points of view about the challenges of the digital business environment and the manager's role and competencies when facing these challenges. This panel was recorded, fully transcribed, and color-coded with the support of the QDA miner software. Based on their empirical experience, experts identified the main competencies required to lead an organization's digital transformation. This research's content analysis is based on a template analysis approach (King and Brooks 2016). The results of this analysis guided the creation of the initial template, which is the basis of our four main categories of competencies: 1) Technical; 2) Managerial; 3) Social; 4) Motivational.

The competencies highlighted by the experts were aligned with the ones described in Goleman et al.'s (2013) model. Besides providing empirical validation of Goleman et al.'s (2013), the specialists described some insights about the technical competencies specific to the digital context, the fast-paced change and turbulence of the digital business environment, and the increased flexibility and simultaneity of the competencies required in today's environment.

Using the initial template as a starting point, we conducted a systematic literature review to understand how previous research has analyzed the subject. It demonstrated complementarity and synergies with the data collected in the webinar with experts on digital transformation from Canada. Consequently, after a detailed analysis of the articles that composed our sample, the initial template was enriched, creating a detailed description of the identified competencies, as described in Figure 1.

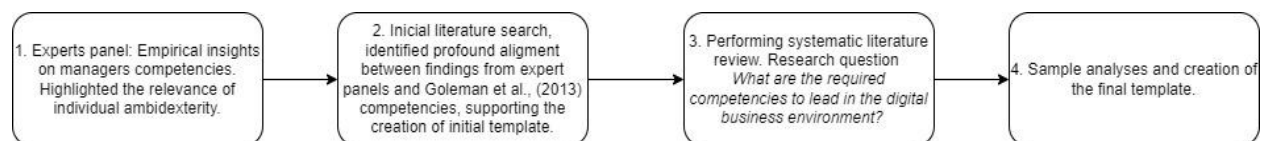


Figure 1. Research Steps

A systematic literature review provides a comprehensive overview of the subject, as a systematic review is a transparent and reproducible method to analyze existing literature. It applies objective criteria to the inclusion or rejection of an article (Okoli and Schabram 2010; Tranfield 2003). We ensured transparency and reproducibility by using guidelines proposed by Tranfield et al. (2003). Thus, below are presented the four phases of the selection process and a summary of the methodology. The first phase of the systematic literature review was to define the databases to collect relevant literature related to the subject. Thus, we have selected three databases for our literature review: ABI/INFORM, EBSCOhost, and Scopus. The second phase involved identifying relevant keywords based on an exploratory review to understand the paper's taxonomy better. The search string was defined as follows:

“Digital literacy” OR Skills OR Competencies OR Capabilities OR Capacities OR “Digital Savvy” AND Manager OR Leader OR CEO OR CIO OR CTO OR “Top Management” OR Director OR Executive AND “Digital transformation” OR “Digital Era” OR “Digital Context” OR Digitalisation OR Digitalization OR “Industry 4.0” OR Digitization OR Digitisation OR “Smart Factor*” OR “Smart Industry*” OR “Smart Company*” OR “Digital Transition.”

Third, we applied the research string for the articles’ titles and abstracts during the search process, and inclusion and exclusion criteria were employed. More specifically, the selected articles were written in English and peer-reviewed. The first three phases allowed us to identify 459 articles related to our research question. The fourth phase consisted of removing the duplicates between the different databases, then assessing the relevance of each article related to our research topic. We first reviewed the title to judge the significance of each of the studies. When the title alone did not capture the essence of an article, we read the abstract to determine whether the paper would be withdrawn or selected for the final studies used for the systematic literature review. Finally, after completing phases 1 to 3 (defining the databases, the search chain, and the inclusion/exclusion criteria), 292 scientific articles related to our subject were identified. With the support of the tool Zotero, 167 duplicates were identified and removed from the analysis, that is, the same articles found in more than one database. Subsequently, analyzing the titles and abstracts of each of the papers allowed us to select our final sample, namely 76 studies that addressed what are the required competencies to lead in the digital business environment. These 76 articles were analyzed, and the results are presented in the following section. The complete list of papers selected is available in Appendix A.

Results and Discussion

Bibliometric Analysis

Analyzing the 76 selected articles, we see that the subject is recent, and interest is growing. The first article identified in our sample was published in 2001, and most of the pieces were published after 2017. Furthermore, 62% of the authors used a qualitative method to conduct their study, 20% used a quantitative method, and 18% used a mixed approach. Therefore, it is possible to understand that research related to competencies needed to lead in the digital business environment is still in an exploratory phase. Considering the comprehensive and multidisciplinary nature of the subject, specialized journals in various areas present publications on the subject. We highlight that the Business Process Management Journal published four selected articles, and the International Journal of Organization Leadership and Business Horizon published three each. Our systematic literature review provides a set of the digital literacy competencies required by business leaders and managers to become effective in a business context in the digital economy era. The 76 selected papers have been analyzed based on the initial template from the expert panel (King and Brooks 2016). We categorized each article using the principal codes following a deep analysis of all competencies mentioned in each paper.

Content Analysis and Discussion

We analyzed papers seeking competencies that literature addressed regarding business leaders and managers in digital transformation and the digital economy.

Our findings present competencies and abilities related to the role and tasks that managers and business leaders oversee, competencies related to their role as leaders for other members of the workforce, and competencies required to anticipate and orient business decisions related to digital technologies and digital strategy. We found a diversity of competencies. The literature is rich in suggesting what managers and business leaders need to master, but this remains very scattered, as most papers address general manager competencies, or a specific competency related to a particular technology.

In line with the research of Laar et al. (2020), our results also stress the technological focus of the existing literature, as most of the selected papers (85.5%) have mentioned that technical and technological competencies are relevant for managers and business leaders. However, contrary to Laar et al.’s. 2020 research, which focused on the workforce, our research suggests that communication and ICT skills are critical managerial competencies for the digital environment. Digital leaders must develop technological and hard skills to undergo digital transformation (Mihardjo and Rukmana 2019). The managerial competencies mentioned by 86.8% of papers highlighted that managers and business leaders require several cognitive and emotional intelligence competencies. These high-level emotional competencies are crucial to achieve an optimal performance in the

digital business environment (Mazurchenko and Maršíková 2019). Hence, managers and leaders need to develop business competencies that encompass soft skills, attitudes, and knowledge, which are equally essential for a successful digital transformation within an organization (Mihardjo and Rukmana 2019). The motivational and social competencies were underlined by 68.4% and 90.8% of the articles, respectively.

While the competencies for managers and non-managers are not the same, our results describe that the required skills for managers in digital transformation are not very different from previous research on high-performance managers (Ogbonnaya and Nielsen 2016). Our results suggest an alignment and synergies with the concept of transformation leadership (Bass and Riggio 2006). Managers and business leaders aligned with the transformational profile promote positive behaviors that affect employees' attitudes and readiness to change (Herrmann et al. 2012). Hence, our results suggest that although the required competencies remain the same, their implementation has changed. Digital tools now support it, and the digital environment requires the development and recombination of diverse, and sometimes, competitive competencies (e.g., efficiency and innovation).

Based on our insights from the expert panel and the literature, we adopted Eshet-Alkalai's conceptual framework (Eshet 2004) for digital literacy and the leadership model on competencies for leaders and managers from Goleman et al. (2013) to propose digital literacy competencies to lead in the digital business environment. We built on four categories of competencies mentioned by experts, which were aligned with the literature to gather competencies required to lead a successful digital transformation. These categories are technical, managerial, social, and motivational competencies, presented and described below in the subsections.

This categorization highlights the different aspects of digital literacy in each required competencies for business leaders and managers. Thus, we propose a deeper understanding of each competency identified in this research by suggesting their adaptation in the digital literacy context. To develop or improve their level of digital literacy, business leaders should focus on acquiring the following competencies and integrating them into their managerial practices (Martin and Grudziecki 2006). The following subsections present a table including an overview of competencies and abilities from the literature, the percentage, and the references of the articles in which these competencies were mentioned. We also present our proposition of contextualization of each competency in the digital literacy competencies context for business leaders and managers (as shown in the last column).

Digital Technical Competencies and Abilities

Digital technical competencies refer to the job-related abilities and knowledge that individuals can be developed through practice and learning supported by skills, attitudes, and knowledge related to information and communication technologies (ICT) and all digital technologies (Łupicka and Grzybowska 2018). Table 1 illustrates that the most frequently mentioned digital technical competencies are "Interdisciplinary/generic awareness and knowledge about technologies" (51.3%)," as well as "Data & Analytical Knowledge" (46.1%)."

Competency & Ability	% of papers	References	Our Proposition in the Digital Literacy Context
<u>Interdisciplinary / generic awareness and knowledge about technologies</u> : Integrate the appropriate disruptive technologies in the business (Łupicka and Grzybowska 2018).	51.3%	[A1, A2, A4, A5, A8, A9, A10, A11, A12, A13, A14, A15, A21, A24, A25, A29, A32, A33, A36, A37, A39, A42, A43, A44, A46, A47, A48, A50, A54, A56, A57, A58, A60, A61, A65, A68, A70, A72, A76]	Understanding the potential of the concepts for business and performance improvements (e.g., Big Data, artificial intelligence, IoT, cloud computing, and so forth) by having generic knowledge of technologies.
<u>Data & Analytical knowledge</u> : Analyzing data for insights and solutions that address business challenges (Łupicka and Grzybowska 2018).	46.1%	[A1, A4, A6, A7, A12, A13, A14, A15, A16, A17, A18, A19, A20, A25, A26, A28, A31, A32, A33, A34, A39, A42, A43, A47, A50, A54, A62, A65, A66, A67, A68, A70, A71, A72, A76]	Using advanced knowledge of statistics, data visualization, gathering information, articulating, analyzing, solving complex problems, making decisions, and some algorithmic programming.

<p>Knowledge Management: Ensuring that organizations can acquire, create, organize, share, use, archive, and build on the needed knowledge for their successful performance (Łupicka and Grzybowska 2018).</p>	<p>42.1%</p>	<p>[A1, A2, A4, A6, A9, A10, A12, A14, A18, A23, A24, A25, A27, A28, A29, A42, A44, A46, A47, A48, A50, A51, A53, A54, A59, A64, A66, A67, A70, A74, A75, A76]</p>	<p>Accessing the proper knowledge at the right time via a robust digital knowledge management system.</p>
<p>Information Technology (IT) knowledge and abilities: Establishing the information technology (IT) infrastructure and applications to work within technical support, maintenance, and development (Łupicka and Grzybowska 2018).</p>	<p>39.5%</p>	<p>[A1, A2, A4, A5, A6, A7, A9, A15, A16, A18, A20, A24, A25, A27, A29, A34, A36, A37, A39, A42, A43, A46, A47, A53, A60, A61, A62, A67, A72, A76]</p>	<p>IT skills are a relatively broad skill set that ranges from hardware deployment and software development to troubleshooting and data analysis to support decision-making and managerial activities.</p>
<p>Digital Security: Being knowledgeable about threats and risks to the people, information, assets, and reputation of your organization, and having the skills to quickly identify vulnerabilities and employ effective and efficient countermeasures (Łupicka and Grzybowska 2018).</p>	<p>27.6%</p>	<p>[A1, A7, A8, A9, A11, A17, A18, A22, A27, A30, A32, A34, A40, A44, A45, A47, A53, A60, A61, A72, A76]</p>	<p>Understanding and applying security knowledge for Web services, antivirus software, smartphone SIM cards, biometrics, and secured personal devices.</p>
<p>Organizational and external context understanding: Understanding the workings, structure, and culture of the organization and the political, social, and economic climate in which it operates (Łupicka and Grzybowska 2018).</p>	<p>23.7%</p>	<p>[A4, A6, A8, A10, A11, A12, A13, A15, A16, A17, A22, A36, A46, A49, A51, A60, A63, A76]</p>	<p>Understanding others' roles, perspectives, and agendas, managing the environmental context in which one operates (e.g., clients, partners, geographical location, and culture), and predicting how new technological opportunities, events, or situations will affect individuals and groups within the organization and is comfortable and versatile in different political, social and business contexts.</p>
<p>Resources Management: Acquiring, allocating, and managing the resources, such as individuals and their skills, finances, technology, materials, machinery, and natural resources required for a business (Caputo et al. 2019).</p>	<p>18.4%</p>	<p>[A15, A24, A28, A33, A34, A36, A37, A46, A47, A50, A51, A53, A67, A76]</p>	<p>Knowing how to take full advantage of and invest wisely in technology so that you do not overspend on it.</p>
<p>Computer programming/ coding abilities: Using various programming languages to write commands, instructing a computer, application, or software about the actions it must perform and how (Łupicka and Grzybowska 2018).</p>	<p>10.5%</p>	<p>[A2, A4, A16, A18, A36, A37, A39, A43.]</p>	<p>Creating APIs and add-ons to complete or improve services based on digital tools.</p>
<p>Specialized knowledge of activities and processes: Expressing specialized knowledge in terms of 'common knowledge (Łupicka and Grzybowska 2018).</p>	<p>9.2%</p>	<p>[A4, A11, A13, A15, A16, A22, A76]</p>	<p>Being able to use special knowledge of the organization's technologies, tools, products, services, research, equipment, techniques, management, or other interests and their application in international markets.</p>
<p>Sensing & Research Skills: Using reliable sources for continuous learning in changing environments and providing in-depth information and advice on a given topic (Łupicka and Grzybowska 2018).</p>	<p>9.2%</p>	<p>[A1, A4, A5, A16, A31, A33, A76]</p>	<p>Use digital tools to find information and evaluate information found in your online sources based on accuracy, validity, appropriateness for needs, importance, and social and cultural context.</p>
<p>Knowledge of Field, Legal / Ethical Basis: Having prior relevant experience in your organization's sector and understanding its related issues, challenges, and opportunities (e.g., business, healthcare, government, or education)</p>	<p>7.9%</p>	<p>[A31, A34, A45, A56, A58, A63]</p>	<p>Being aware of new technologies in the field of your sector, as well as how legitimate their implementation is in your organization from a legal and ethical point of view.</p>

<u>Social Media Capabilities</u> : Using social networking sites, social media messaging, and social media knowledge (Herhausen et al. 2020).	6.6%	[A30, A44, A49, A51, A64]	Analyzing social media audiences and developing a strategy that's tailored to them, creating and distributing content for social media profiles, monitoring online conversations, collaborating with influencers, providing community service, and monitoring, measuring, and reporting on social media performance and ROI (e.g., Facebook, Instagram, Twitter, LinkedIn, TikTok, etc.).
<u>Ability to attract investment for the project implementation</u> : Having experience finding an influential investor (Alekhina et al. 2020).	2.6%	[A35, A51,]	Using digital tools to find an investor for your innovative ideas (apps, social media, digital platforms, incubators, accelerators, etc.).
Table 1. Digital Technical Competencies			

Digital Managerial Competencies and Abilities

Digital managerial competencies include the various skill, abilities, and attitudes required for leaders to make informed decisions as well as resolve problems effectively supported by skills, attitudes, and knowledge related to information and communication technologies (ICT) and all digital technologies. (Łupicka and Grzybowska 2018). Table 2 demonstrates that the most frequently mentioned digital managerial competencies are “Strategic Scanning & Intelligence” (44.7%), “Innovation & Creativity” (43.4%), and “Adaptability & Flexibility” (36.8%).

Competency & Ability	% of papers	References	Our Proposition in the Digital Literacy Context
<u>Strategic Scanning & Intelligence</u> : Understanding what is happening in the market and determining what is possible and most likely to occur. Scanning should involve predicting new threats and finally guiding management towards digital solutions obtained through combinations and reverse thinking (Anghel 2019).	44.7%	[A6, A8, A10, A11, A12, A13, A14, A16, A17, A23, A24, A30, A33, A39, A41, A42, A46, A47, A48, A49, A50, A51, A53, A55, A56, A57, A58, A59, A60, A66, A67, A70, A74, A76]	Calling on the imagination of new threats to guide management toward digital solutions obtained, for example, by combinations and reverse thinking. Learn innovative methods to produce, serve and meet customer needs according to technological developments in the market.
<u>Innovation & Creativity</u> : Perceiving the world in new ways, finding hidden patterns, making connections between seemingly unrelated phenomena, and generating solutions (Łupicka and Grzybowska 2018).	43.4%	[A3, A6, A7, A12, A13, A16, A17, A18, A20, A24, A25, A30, A33, A34, A39, A45, A46, A47, A48, A49, A50, A51, A52, A56, A57, A58, A59, A65, A66, A68, A70, A74, A76]	Engaging the right people, at the correct times, to the right degree in creative work, encouraging and enabling collaboration, using collaborative digital tools, open the organization to diverse perspectives (e.g., collective intelligence, co-creation, prosumers).
<u>Adaptability & Flexibility</u> : Having the capacity to adapt and be flexible in new, complex, changing, and challenging situations while learning quickly (Kuzin 2018).	36.8%	[A12, A19, A20, A30, A32, A33, A34, A35, A36, A39, A40, A42, A44, A46, A47, A48, A50, A54, A55, A57, A58, A61, A65, A67, A68, A70, A73, A76]	Predicting or perceiving quickly evolving business needs and adjusting through new technology, process, and workforce management combinations.
<u>Active Digital Innovation skills</u> : Being the initiators of innovations and creating an appropriate organizational climate so that all the employees use innovative thinking to solve problems and develop new products (Alekhina et al. 2020).	32.9%	[A7, A9, A10, A11, A13, A27, A30, A34, A37, A39, A42, A45, A46, A47, A50, A51, A52, A55, A57, A58, A61, A68, A70, A73, A76]	Using digital technology and applications to improve existing business processes and workforce efficiency, enhance customer experience, and launch new products or business models.
<u>Entrepreneurial thinking</u> : Identifying marketplace opportunities and discovering the most appropriate ways and time to	32.9%	[AA, A6, A8, A9, A10, A11, A12, A14, A21, A22, A25, A28, A33,	Seeking opportunities to apply digital technologies to create business value.

capitalize on them. It is more like a state of mind that opens your eyes to new opportunities (Łupicka and Grzybowska 2018).		A37, A47, A48, A49, A50, A51, A53, A56, A57, A58, A59, A67]	
Decision making: Making choices by identifying a decision, gathering information, and assessing alternative resolutions (Łupicka and Grzybowska 2018).	32.9%	[A3, A6, A7, A11, A12, A15, A18, A19, A24, A30, A39, A40, A45, A51, A56, A59, A62, A63, A66, A67, A73, A76]	Using facts, metrics, and data to guide strategic business decisions that align with the organization's goals, objectives, and initiatives.
Accepting change/Change management: Initiating changes or managing them and mediating in the implementation of changes so as not to cause disputes (Łupicka and Grzybowska 2018).	30.3%	[A2, A6, A8, A9, A11, A19, A20, A30, A33, A35, A36, A39, A42, A44, A45, A46, A48, A50, A57, A58, A64, A70, A76]	Accepting the impact of integrating digital technology on the organization's culture, work environment, processes, and so forth and using digital platforms to communicate changes.
Problem Solving: Analyzing a situation, identifying possible/appropriate leadership styles and courses of action, and ensuring follow-through (Łupicka and Grzybowska 2018).	25.0%	[A6, A7, A12, A16, A17, A20, A30, A33, A34, A39, A41, A42, A51, A56, A59, A63, A68, A74, A76]	Identifying, evaluating, selecting, and using digital technologies and possible technological responses to solve a given task or problem.
Critical thinking: Understanding the logical connections between ideas, identifying the relevance and importance of arguments, detecting errors in reasoning, and making proper decisions (Carillo 2017).	15.8%	[A18, A23, A30, A33, A45, A46, A49, A56, A59, A65, A68, A74]	Drawing conclusions based on relevant data collected online, personal knowledge, and experience.
Dynamic Capability: Sensing, seizing, and acting in response to the rapid changing in technology and the market (Mihardjo et al. 2019).	15.8%	[A45, A41, A44, A47, A50, A55, A57, A58, A59, A61, A67, A75]	Developing and maintaining a competitive advantage by identifying opportunities and risks related to the digital transformation, understanding the potential of the digital transformation for the organization, and reconfiguring resources to integrate digital tools and stand out from the competition with new digital business models.
Change, Risk & Crisis Management: Promoting and effectively guiding change and innovation, anticipating and managing risks, and coping effectively with unexpected crises (Billington and Ellersgaard 2017).	15.8%	[A12, A16, A23, A30, A35, A39, A42, A50, A60, A64, A70, A76]	Improving the evaluation and monitoring of risk through digital processes. It may include cybersecurity, third-party, operational, and numerous other types of risk.
Inquisitive Mindset: Having a curious and passionate attitude toward analytics-based business problems (Carillo 2017).	11.8%	[A18, A30, A45, A47, A51, A56, A58, A68, A74]	Participating in an ongoing learning journey through technology providing communicative and content-driven devices, such as virtual reality (VR) and augmented reality (AR).
Set & Manage Control: Effectively delegating authority (Dzwigol et al. 2020).	9.2%	[A24, A25, A44, A50, A51, A60, A63]	Delegating authority for digital initiatives to a technology specialist (e.g., CDO) to overcome the slow pace of digital transformation.
Efficiency Orientation: Stressing the efficient use of resources as the primary determinant for decision and action (Łupicka and Grzybowska 2018).	9.2%	[A1, A6, A12, A17, A34, A52, A62]	Updating your hardware to run developing and new software at a fast speed (computer, external storage, router, wi-fi speeds, or even a printer).
Planning skills/Organized: Integrating practices like time management, scheduling, prioritizing through to-do and to-don't lists, project management skills, consistent communication, multi-tasking, and flexibility as well as adaptability (Billington and Ellersgaard 2017)	3.9%	[A12, A16, A17]	Scheduling projects, meetings, and other tasks by creating time blocks in virtual calendars and keeping a list of functions with digital tools.
Intuition: Trusting your intuition and facts and data (Billington and Ellersgaard 2017).	3.9%	[A12, A59, A62]	Learning how to target intuition towards innovative and technological opportunities.

Table 2. Digital Managerial Competencies

Digital Social Competencies and Abilities

Digital social competencies comprise an individual’s social values and abilities supported by skills, attitudes, and knowledge related to information and communication technologies (ICT) and all digital technologies. (Łupicka and Grzybowska, 2018). Although technical skills have long predominated in terms of the skills required by business leaders and managers, social competencies are now increasingly crucial within an organization. Table 3 shows that digital social competencies are represented mainly by “Communication skills” (50.0%), the “Ability to be Compromising & Cooperative” (35.6%), and the “Ability to Work in a Team” (35.6%).

Competency & Ability	% of papers	References	Our Proposition in the Digital Literacy Context
Communication Skills: Effectively interacting in interpersonal, group, organizational, and public settings - including both message-sending and message reception in varying contexts and with varying individuals and groups (Łupicka and Grzybowska 2018).	50.0%	[A2, A6, A7, A8, A9, A12, A15, A17, A18, A21, A22, A23, A24, A27, A30, A33, A37, A39, A40, A44, A46, A40, A41, A46, A47, A48, A49, A50, A51, A64, A65, A66, A68, A70, A72, A73, A74, A76]	Communicating via digital platforms in a manner that is clear and organized, avoids errors and miscommunication, and is not excessive or detrimental to performance.
Ability to be compromising and cooperative: Experiencing feelings from the point of view of other employees and trade partners & having an active interest in their concerns, anxieties, and worries (Łupicka and Grzybowska 2018).	35.6%	[A2, A6, A8, A16, A17, A19, A20, A30, A34, A39, A40, A45, A46, A40, A41, A44, A47, A49, A50, A51, A57, A58, A61, A65, A67, A68, A73]	Encouraging and supporting cooperation using collaborative digital tools promoting co-creation, sharing of ideas, etc. (e.g., Microsoft Teams, Google Suite, etc.). Encouraging the sharing of ideas/comments through electronic platforms (e.g., forums).
Ability to Work in a Team: Securing collaboration between all group members to achieve a collective goal (Łupicka and Grzybowska 2018).	31.6%	[A6, A7, A8, A11, A12, A16, A17, A23, A30, A39, A46, A46, A47, A50, A51, A52, A53, A63, A65, A66, A69, A70, A72, A73]	Leveraging technologies (tools, apps, software, procedures, processes) to improve workplace collaboration, communication, document management, content management, and information flow. Cloud is an integral part of digital collaboration.
Agility: Cultivating mood, psyche, and tools to shift strategy fast (Billington and Ellersgaard 2017).	30.3%	[A12, A16, A23, A25, A30, A33, A34, A39, A40, A41, A42, A46, A47, A48, A55, A59, A61, A62, A64, A67, A70, A73, A76]	Rapidly enabling, updating, changing, or adapting the organization's processes, tools, software, etc.
Diversity & Intercultural Relations: Valuing and working effectively with individuals of varying cultural, racial, ethnic, political, or lifestyle orientations (Łupicka and Grzybowska 2018).	26.3%	[A2, A6, A11, A12, A15, A17, A20, A21, A32, A36, A42, A51, A54, A55, A57, A58, A66, A67, A68, A72]	Interpreting documents and artifacts from various cultural contexts, effectively communicating messages, and interacting constructively with interlocutors across different cultural contexts via digital platforms.
Ability to transfer knowledge: Sensing the need for growth in other people and developing skills in employees (Łupicka and Grzybowska 2018).	23.7%	[A1, A2, A6, A8, A17, A18, A20, A25, A27, A32, A40, A42, A46, A48, A53, A69, A70, A73]	Using convenient digital technologies to collect, store, and deliver essential knowledge to employees (video captured presentations, social and collaborative tools such as chat, forum, intranet, blog postings, etc.) and digital knowledge management systems.
Networking Abilities: Creating long-lasting, quality partnerships (Lavalle and Casale 2020).	19.7%	[A7, A17, A30, A39, A50, A55, A57, A59, A61, A65, A67, A69, A70, A72, A74]	Expanding your network of social and business relationships through online communication channels, such as social media platforms like LinkedIn, Facebook, Instagram, and Twitter.
Involvement & Empowerment: Effectively engaging others in decision-making and other activities (Billington and Ellersgaard 2017).	17.1%	[A1, A3, A7, A10, A11, A13, A17, A30, A34, A39, A44, A48, A50]	Supporting other digital innovators within the organization and including the input and competence of others in decisions such as implementing new technologies, processes, tools, etc.

Customer-Awareness: Having an understanding and willingness to meet and exceed customer expectations (Billington and Ellersgaard 2017).	13.2%	[A12, A20, A33, A36, A45, A51, A53, A56, A59, A69]	Collecting data with digital technologies (Big Data/IoT) to have a real-time portrait of customer behavior and consequently offer a personalized digital customer experience.
Emotional Intelligence: Using emotion for motives, troubleshooting, handling relationships, and improving thinking and performance (Calvin et al. 2017).	11.8%	[A12, A16, A30, A33, A40, A47, A54, A65, A70]	Being able to sense emotional responses digitally— your own or other people’s—and use this affective information to guide thinking, behavior, and decisions.
Facilitation, Negotiation, & Conflict Resolution: Encouraging discussion and expressing varying points of view, encouraging compromise, and effectively addressing tensions and conflicts (Caputo et al. 2019).	3.9%	[A17, A66, A76]	Settling disputes through an online mode of communication/interaction between the disputed parties.
Intergenerational Relations: Handling multi-generational teams, including understanding their strengths and weaknesses, their work culture, and their aspirations (Nair 2019).	1.3%	[A20]	Choosing the right technologies and tools that can combine the disparate workforce, as well as helping the employees understand the importance of introducing these digital tools.

Table 3. Digital Social Competencies

Digital Motivational Competencies and Abilities

Establishing an inspiring vision and constantly working on self-development are crucial elements motivating the workforce. Innovative leadership creates a need for business leaders to acquire motivational competencies to ensure a successful digital transformation within their organization. Digital motivational competencies comprise an individual's skills and abilities to motivate the workforce to ensure they are actively involved in the transformation's success, supported by skills, attitudes, and knowledge related to information and communication technologies (ICT) and all digital technologies (Alekhina et al. 2020). Table 4 highlights that the motivational competencies are most often represented by having practical “Leadership Skills” (43.4%), having an “Innovative Practice & being Success Driven” (42.1%), and “Vision-Setting, Strategy Development, & Goal Attainment” (38.2%).

Competency & Ability	% of papers	References	Our Proposition in the Digital Literacy Context
Leadership skills: Inspiring employees, directing them, and mastering the methods of effective persuasion (Łupicka and Grzybowska 2018).	43.4%	[A1, A2, A6, A7, A8, A9, A11, A12, A14, A16, A17, A23, A27, A30, A35, A39, A40, A42, A44, A45, A46, A47, A50, A54, A57, A58, A61, A63, A65, A68, A70, A72, A73]	Navigating your organization towards digital transformation to stay competitive and agile in a rapidly evolving digital and social media landscape (setting the vision, creating sustainable digital programs, tracking impact, etc.).
Innovative Practice & Success Driven: Possessing a broad vision, an innovative spirit, and the desire to lead the organization to success (Alekhina et al. 2020).	42.1%	[A1, A2, A4, A5, A6, A7, A9, A10, A12, A13, A21, A23, A25, A30, A32, A34, A35, A36, A37, A38, A39, A42, A43, A48, A51, A52, A53, A54, A56, A57, A58, A71]	Being motivated to apply innovations yourself, being at the head of the “innovation transformation” to contribute to the company's competitiveness.
Vision-Setting, Strategy Development, & Goal Attainment: Motivating and providing a sense of purpose and direction, developing approaches and goals, and ensuring follow-through (Caputo et al. 2019).	38.2%	[A2, A4, A5, A6, A7, A10, A13, A13, A14, A19, A20, A21, A22, A23, A25, A28, A30, A32, A34, A36, A38, A39, A41, A51, A52, A57, A58, A64, 71,]	Creating a digital vision that is forward-looking and defines "who we want to become" as an organization in light of emerging technologies.

<u>Psychological readiness for change & Constant self-development</u> : Being ready to change yourself and constantly seeking to evolve (Alekhina et al. 2020).	32.9%	[A10, A14, A21, A25, A28, A29, A31, A34, A35, A37, A41, A42, A44, A45, A46, A47, A48, A50, A54, A55, A56, A65, A69, A70, A76]	Pursuing opportunities for personal and professional learning, growth, and advancement by effectively integrating digital tools as ongoing learning programs.
<u>Influence & Persuasion</u> : Convincing others to adopt advocated ideas, points of view, or behaviors (Caputo et al. 2019).	28.9%	[A15, A17, A18, A25, A28, A29, A30, A33, A35, A38, A44, A47, A50, A51, A52, A56, A57, A58, A60, A64, A66, A76]	Creating an effect, changing opinions and behaviors, and driving measurable outcomes, for example, through online reviews, comments, etc.
<u>Self-Discipline & Self-Confidence</u> : Having self-control, focus, and confidence in your capabilities (Vaidya, Prasad, and Mangipudi, 2020).	19.7%	[A5, A13, A25, A32, A36, A50, A43, A44, A56, A51, A51, A53, A57, A58, A71]	Having self-motivation for long-life learning, confidence in your digital skills, and the ability to lead in the Digital Era.
<u>Courageous & Risk-taking</u> : Having the willingness to take sound, calculated risks based on good judgment in situations where the outcome is uncertain (Alekhina et al. 2020).	19.7%	[A1, A2, A4, A6, A13, A14, A18, A23, A23, A27, A34, A42, A56, A53, A71]	Adopting a new technology to replace old systems, proposing changes using digital tools, and encouraging experimentation with digital technologies.
<u>Role Modelling</u> : Enacting the values and behaviors that one advocates for others (Łupicka and Grzybowska 2018).	17.1%	[A12, A16, A30, A33, A40, A41, A42, A50, A51, A64, A67, A72, A73]	Increasing your transparency and accountability to engage trust with the workforce and customers, for instance, with the intelligent use of data through sophisticated digital tools and encouraging ethical values.
<u>Credibility & Trust</u> : Being admired and seen as authoritative, honest, transparent, competent, and trustworthy (Łupicka and Grzybowska 2018).	17.1%	[A12, A16, A30, A33, A40, A41, A42, A50, A51, A64, A67, A72, A73]	Establishing a high level of confidence in people, processes, and technology to build a secure digital world.
<u>Self-Assessment</u> : Analyzing your thoughts, emotions, and reactions (Alekhina et al. 2020).	9.2%	[A12, A33, A39, A40, A54, A66, A68]	Monitor your progress and areas of improvement both professionally and personally by using digital tools such as online self-assessment questionnaires.

Table 4. Digital Motivational Competencies

Our findings suggest that the concept of digital literacy for business leaders and managers goes beyond the variety of complex cognitive, motor, sociological, and emotional skills described by Eshet (2004). It includes a set of soft competencies mainly related to managers' capacity to establish, communicate, and engage the whole organization around a digital strategy and the implications of digital transformation to the organization's competitiveness. Our findings on business leaders' digital literacy involve the relevance of technical and managerial competencies related to managing knowledge and resources. It also establishes priorities to support and coach employees and managers. Four categories of competencies were highlighted in this research: 1) Technical; 2) Managerial; 3) Social; 4) Motivational. These categories cover all attributes identified about business leaders and managers' digital literacy.

Then, we propose that digital literacy for business leaders and managers is the ability to use digital technologies to find, evaluate, create, and communicate data and information, requiring technical, managerial, social, and motivational competencies. It thus includes a set of competencies that brings together several skills, attitudes, and knowledge related to digital and emerging technologies.

Conclusion

The Digital Era has completely revolutionized how businesses operate, bringing its share of challenges and opportunities that digital transformation leaders and managers must harness and manage adequately (Schrage et al., 2021). Our systematic literature review provides required competencies to lead in the digital business

environment. This review aimed to investigate the necessary competencies for managers and business leaders to guide their organizations to thrive in the digital business environment. Consequently, this study identified gaps in the literature regarding those competencies and opportunities for future research.

Managerial Contributions

Considering the results of the systematic literature review and the experts' insights, the main difference related to competencies in the digital environment is the pace of changes and the intermediation of digital technologies to support managers' tasks. Moreover, we highlight digital managers' capacity to perform competitive activities simultaneously (e.g., maximizing efficiency and optimizing processes while promoting an agile and open environment for collaboration and innovation (O'Reilly and Tushman 2013)). In this research, we point out that individual ambidexterity (Good and Michel 2013) is required to manage the digital business environment effectively. At the individual level, the most successful managers can develop ambidexterity by achieving the optimal balance between the competitive activities of exploration (Tushman et al. 2011). Moreover, ambidexterity enables business leaders and managers to perform their roles adequately and to be more effective, aligning short-term organizational goals with the long-term and continuous characteristics of digital transformation (Kane et al. 2019; Schrage et al. 2021). It also drives them to become better business leaders or managers, achieve the organization's technological objectives, and use valuable technologies in their roles. In line with O'Reilly and Tushman's (2004) research, ambidexterity could be analyzed as a dynamic capability that supports the creation and adaptation of other capabilities as identified in the systematic literature review: sensing, seizing, and transforming.

By categorizing competencies in this way, this study allows managers and leaders to gain practical knowledge of their skill level while becoming aware of the different types of competencies they must master to lead a successful digital transformation. Therefore, they can effectively guide which competencies and abilities are missing in their skillset and organization. In other words, business leaders and managers must master hard skills. Still, they will have to develop several soft skills that will allow them to overcome the challenges derived from digital transformation (Schrage et al. 2021). Furthermore, it is of paramount importance that business leaders and managers establish an innovation culture within the company so that the workforce may evolve and partake in digital transformation (Caputo et al. 2019). Thus, it is crucial to provide them with the appropriate tools and improvement methods (Antonucci et al. 2020). Moreover, this paper provides further managerial contributions by suggesting a definition of digital literacy aligned with the challenges of digital transformation and the managerial context.

Theoretical Contributions

First, our results suggest that companies require more individuals to adequately lead the digital transformation by identifying, supporting, transferring, and managing innovation to create value within the organization. Therefore, business leaders and managers must be highly skilled in digital literacy to achieve high performance (Łupicka and Grzybowska, 2018). Furthermore, we identified four types of competencies to support future research on the subject, namely technical, managerial, social, and motivational. Then, with the expert panel's support, we validated Goleman et al.'s (2013) model by identifying alignments and synergies with the collected empirical data. By adopting a template analysis, our research resulted in a final template that detailed descriptions of the required competencies for leading in the digital business environment. Finally, by identifying the competencies required by professionals leading the digital transformation, we bring two contributions. We extend the individual ambidexterity (Good and Michel 2013) and the adaptation of some competencies that are essential to the dynamic capabilities in the digital business environment (O'Reilly and Tushman 2004).

Final Remarks, Limitations, and Future Research

Our findings present the required competencies to lead in the digital business environment. These contributions are based on the insights from the expert panel, and the literature analyzed. We suggest that managers and business leaders develop individual ambidexterity to handle the digital business environment, besides creating and reorganizing some dynamic capabilities such as sensing, seizing, and transforming. This paper extends the concept of digital literacy for managers and business leaders by providing a detailed competencies set for them (Bolek et al. 2018). It also explains the core differences between the employees' (Kozanoglu and Abedin 2020) and the leaders' roles in digital transformation and complements previous research on managers' digital literacy (Yanto et al. 2022).

It is important to note that this research identified and categorized the main competencies in recent academic contributions to the subject, however some limitations should be considered. First, we have comprehensively identified the competencies to ensure a digital transformation's success within a company. However, it would be difficult for a single person to master all the competencies identified. Thus, future research should determine how these competencies could be divided between different business leaders so that each one performs his role optimally. Second, this study is intended to be qualitative and descriptive, which means that we have not assessed the importance of each competency. Future research should quantitatively test each competency's significance and priority level to determine a specific order in which business leaders should focus on them. This kind of study would be interesting within a focused context. It would also be interesting to investigate differences among different geographic areas. Third, this review highlights the required competencies to lead in the digital business environment but does not explore the different ways for leaders to develop them. It would be interesting to create a tool allowing business leaders to build their competencies while monitoring their progress towards their goals in future research. Further research could also explore how to update business schools' curriculums to include these competencies when training future leaders and managers. Because digital literacy is an essential part of leadership, it would also be interesting to study its link with digital transformation impacts. Furthermore, the temporary validity of the study's outcome is another limitation as to the importance of data, as analytical knowledge is the trend in the last few years, and each trend finishes by settlement, then declines.

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Appendix A – Systematic review references selected

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